Baseline Vegetation and Soil Assessment at Red Dome Mine

M/027/032

Prepared for:
Red Dome Mine
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INTRODUCTION

Red Dome Mine has been requested to submit a mine plan for their mine in Millard County. This mine is located in T21S, R6W in sections 22, 23, 26 and 27. These sections are included on the Tabernacle Hill and Meadow Quadrangles. As part of the mine plan, a soil and vegetation assessment is needed in order to evaluate baseline conditions. The purpose of this report is to provide this baseline characterization of soils and vegetation of the area according to the requirements of the Utah Oil, Gas and Mining Division to assist in the creation of a site appropriate and effective reclamation plan.

SITE DESCRIPTION

The area lies on the eastern side of Millard County, about 10 miles West of the town of Fillmore, and 6 miles West of Interstate 15. The area lies at about 4700 to almost 5000 feet elevation and receives about 15 inches of precipitation annually. Most precipitation arrives as snow from October to April. The freeze free season is approximately June 4 to September 15, or an average of about 117 days (NRCS, 1995).

The slopes of the Red Dome Mine permitted boundary range from 2 to about 25%. The topographic relief of the mine itself is somewhat unique for the area, as the area surrounding the mine is more uniform in slope. The prominent knoll of the mine is a result of basalt and basaltic andesite, which occurs in widespread lava flows, shield volcanoes and cinder cones. This variation in topography, in addition to past and present land use and disturbances within the area, are major determinants of soil and vegetation type.

Vegetation is sparse in areas of the lava flows, but where it does occur, the vegetation is dominated by sagebrush (*Artemisia tridentata* var. *wyomingensis*), broom snakeweed (*Gutierrezia sarothrae*), cheatgrass (*Bromus tectorum*) and limited perennial native grasses such as Indian ricegrass (*Oryzopsis hymenoides*), Sandberg's bluegrass (*Poa secunda*), and needle and thread grass (*Stipa comata*). Due to drought and various disturbances, the vegetation community at the Red Dome Mine site is not currently at its full potential. The NRCS list of the potential vegetation communities in the area is included in Table 1.

Figure 1. Vegetation community in Red Dome Mine area

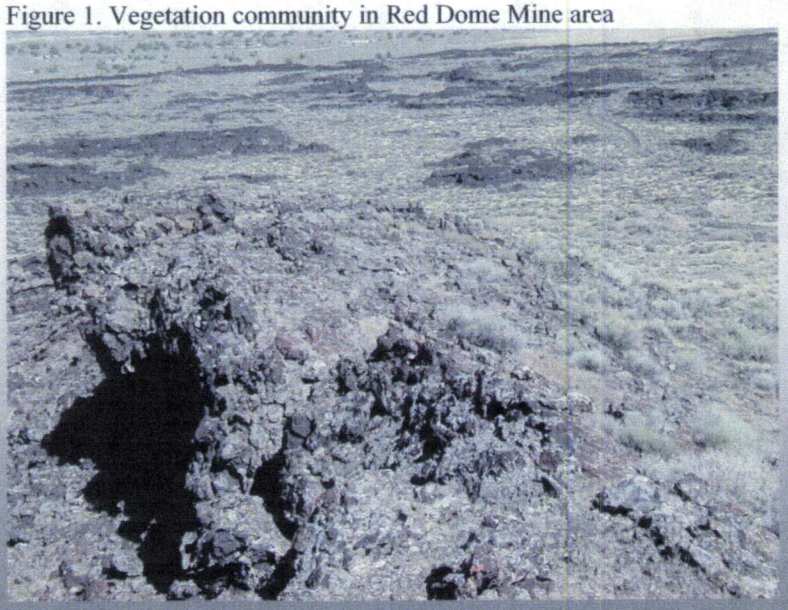


Figure 2. Vegetation community just South of Red Dome Mine

SOILS

The NRCS soil survey delineates the Cinders area as one soil type - Lava flows- Shotwell complex. This soil type consists of about 60% lava flows, 25% of the Shotwell complex and 5% inclusions of each of: Boxelder silt loam, Cloyd gravelly loam and Kessler silt loam. The following soils map depicts the soil type distribution and the numbers assigned to each soil type. Table 1 below depicts the characteristics of each of these soils found within the property of Red Dome Mine as well as details of the potential vegetation community for each soil type.

Figure 3. Soil Types at Red Dome Mine

See text for descriptions of soil numbers/ types

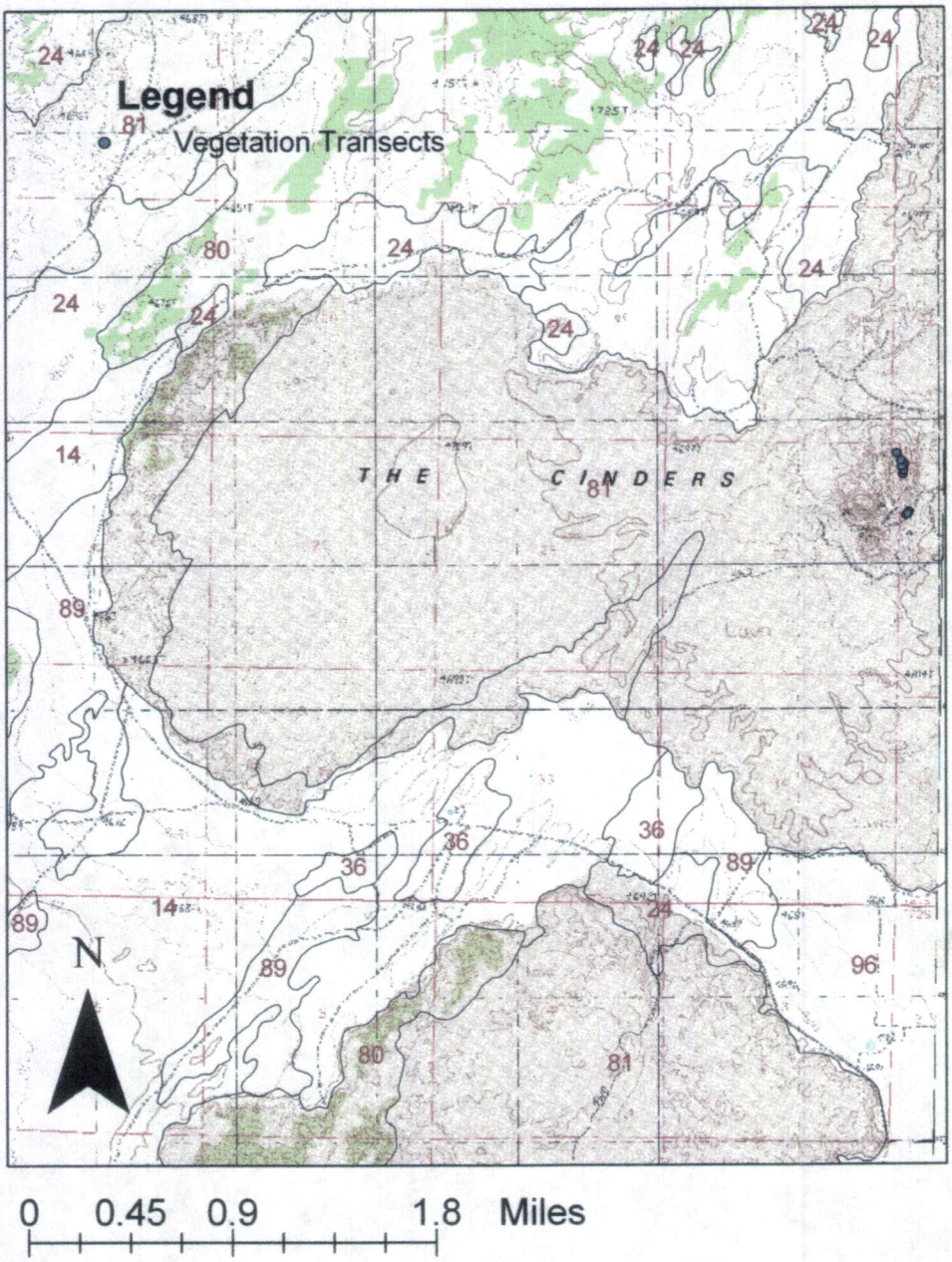
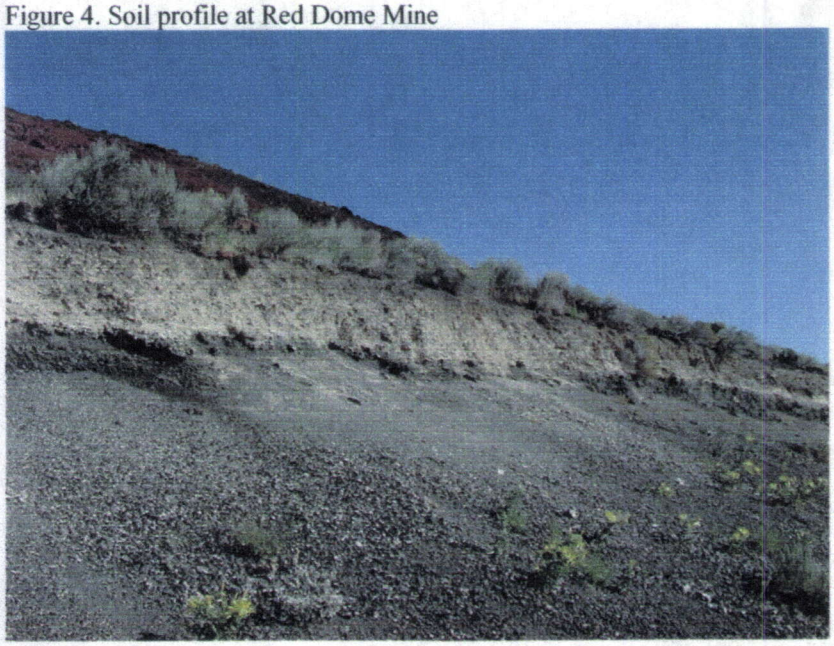


Table 1. Soil types and descriptions

Soil Type, Number	Soil Taxonomic class	Soil Name	Texture	Depth of bedrock	Potential vegetation type	Origin of soil
81		Lava flows	Lightweight cinders	At surface	None-nearly devoid of plants	Quaternary lava flows
81	Lithic Xeric Torriorthents	Shotwell	0-3"-very cobbly loam 3-14"- loam	14 inches	**Semidesert shallow loam** 20% Bluebunch wheatgrass 20% Wyoming big sagebrush 10% Indian ricegrass 10% Nevada bluegrass 5% each of Needle and thread, bottlebrush squirreltail, other perennial grasses, gooseberryleaf globemallow, other perennial forbs, Nevada Mormon tea, and Mexican cliffrose	Residuum derived from basalt and cinders
23,24	Xeric Haplocalcids	Boxelder silt loam	0-5" - silt loam 5-27"- loam 27-60" silt loam	Greater than 60 inches	**Semidesert limy loam** 20% Bottlebrush squirreltail 15% Wyoming big sagebrush 15% Indian ricegrass 10% Other shrubs 10% Other perennial grasses 5% each of rubber rabbitbrush, other perennial forbs, Winterfat, western wheatgrass, other annual forbs, and scarlet globemallow	Alluvium derived from calcareous sediment
31	Lithic Xeric Haplocalcids	Cloyd gravelly loam	0-3"- gravelly loam 3-7"- cobbly loam 7-15"-gravelly loam	15 inches	**Semidesert shallow loam** Vegetation listed above	Residuum derived from travertine
73,74	Xeric Haplocalcids	Kessler silt loam	0-15"-silt loam 15-60"-silt loam	Greater than 60 inches	**Semidesert loam** 25% Bluebunch wheatgrass 20% Wyoming big sagebrush 10% Indian ricegrass 10% Other shrubs 10% Bottlebrush squirreltail 5% each of needle and thread, Hood phlox, Douglas rabbitbrush, scarlet globemallow, and penstemon	Alluvium and lacustrine deposits

* Scientific names of plant species included at end of report

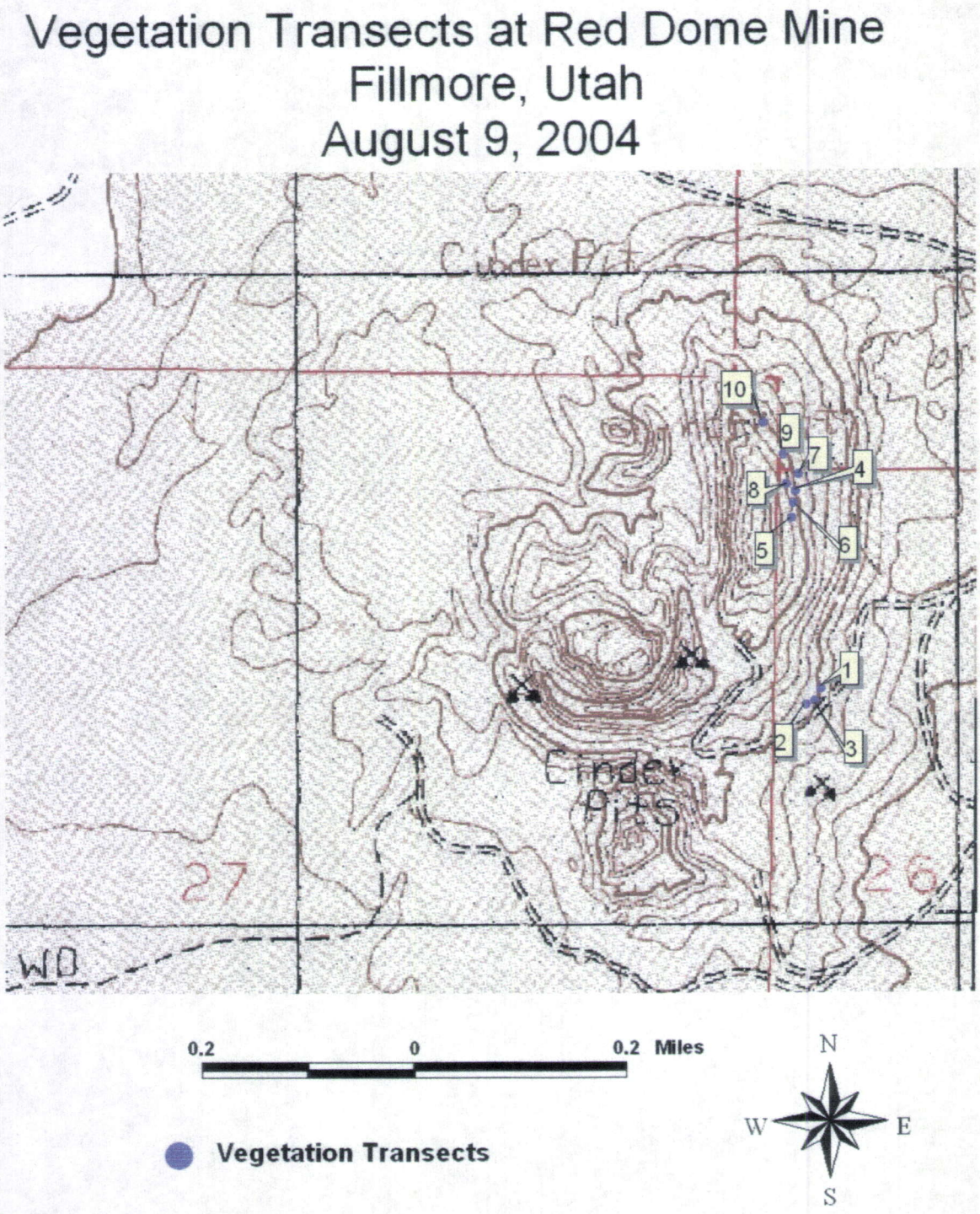
Figure 4. Soil profile at Red Dome Mine



METHODS

To ascertain the range of variability for vegetation cover, ground cover, and species composition, 10 transects of 100 feet each were established in areas within the mine property (See Figure 5). Once within a stand of typical vegetation, a pin was spun to randomly determine the azimuth of the transect. At each foot, vegetation (by species), litter, rock, gravel, or bare ground was recorded. The ten transects were placed in the mining area where the quarry supervisor located as undisturbed vegetation for a total of 100 points each. The vegetation assessment was completed on August 9, 2004.

Figure 5. Location of vegetation transects at Red Dome Mine

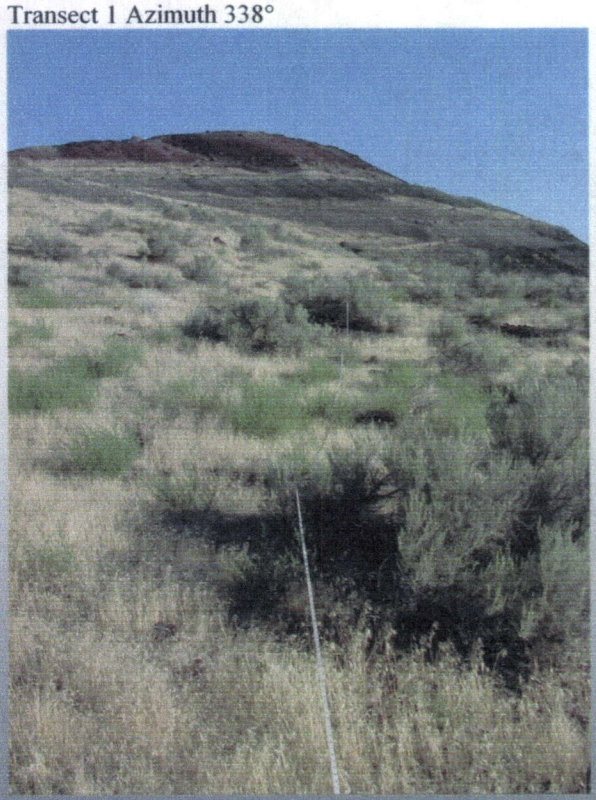


RESULTS

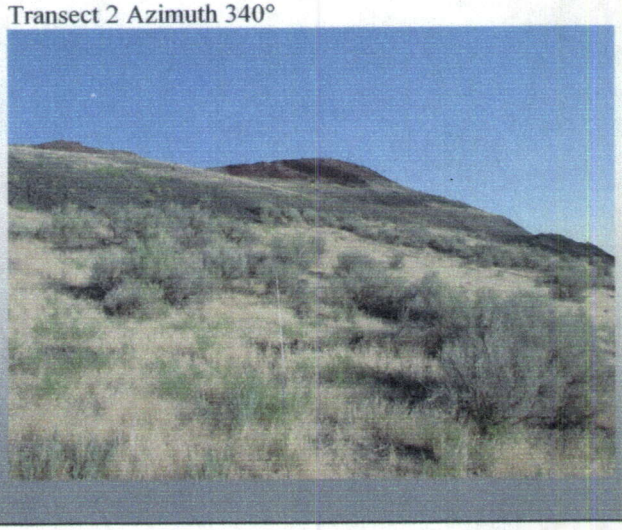
Vegetation communities at the site are in various stages of recovery/regneration and/or degeneration according to past disturbance histories and land use practices. The litter on most of the site was artificially high due to the high concentrations of cheatgrass.

Overall vegetation/ ground cover- Total vegetation cover is 29.7% +/- 8.8%. This includes weedy annual grasses. Litter, bare ground, gravel and rock cover were17.8% +/- 4.8%, 2.9% +/- 3.4%, 36.9% +/- 10.2% and 13.9% +/- 13.5% respectively. Wyoming big sagebrush (*Artemisia tridentata var. wyomingensis*), is clearly the dominant shrub (15% relative cover), with broom snakeweed (Gutierrezia sarothrae) contributing only 2% of the relative cover. Perennial grasses only comprised 0.7% relative cover. Native annual forbs contributed only 0.75% relative cover. Complete tabulated results are shown in Table 2.

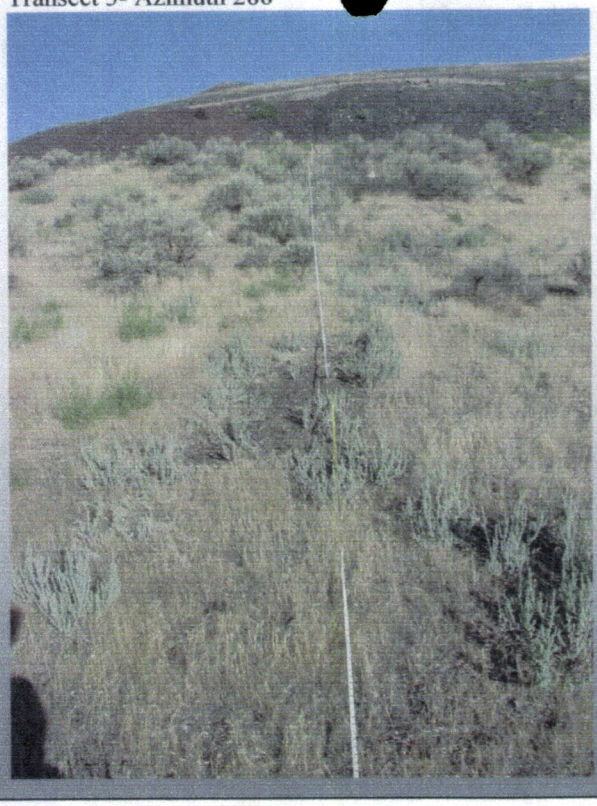
Transect 1 Azimuth 338°



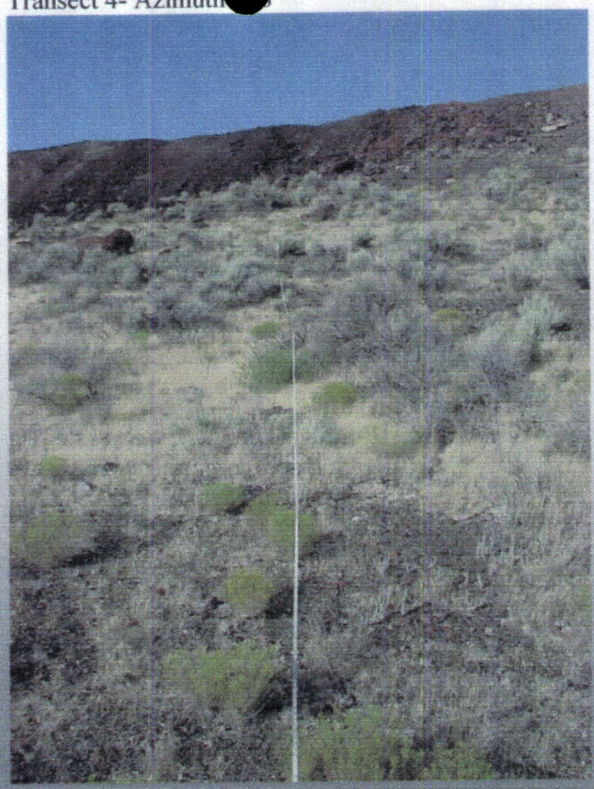
Transect 2 Azimuth 340°



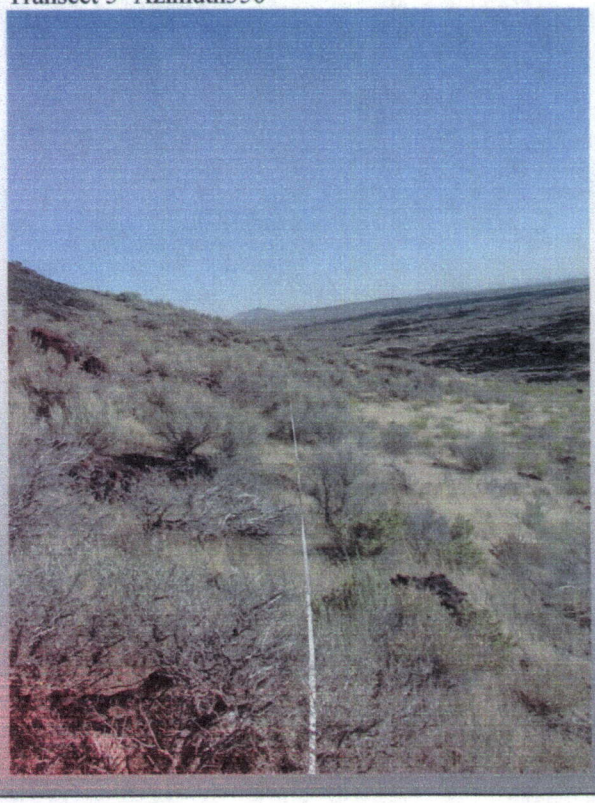
Transect 3- Azimuth 288°



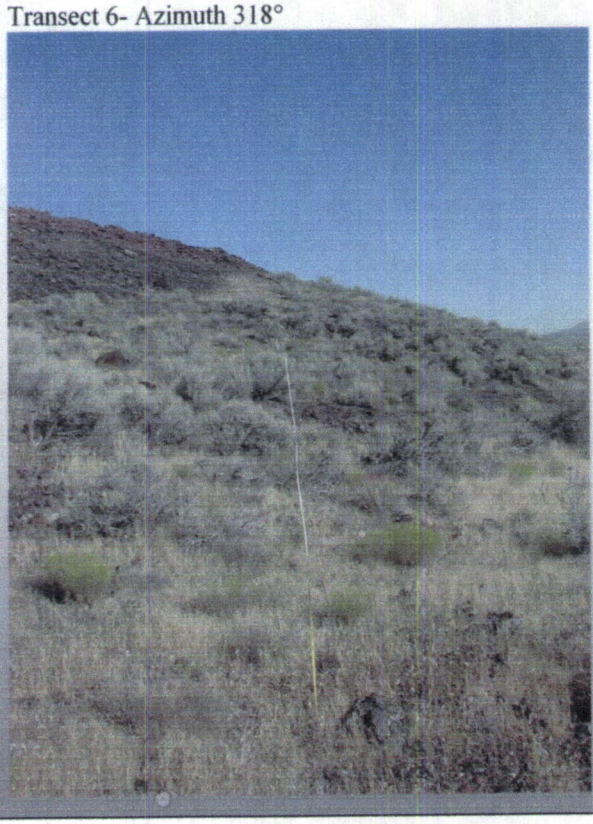
Transect 4- Azimuth [redacted] °



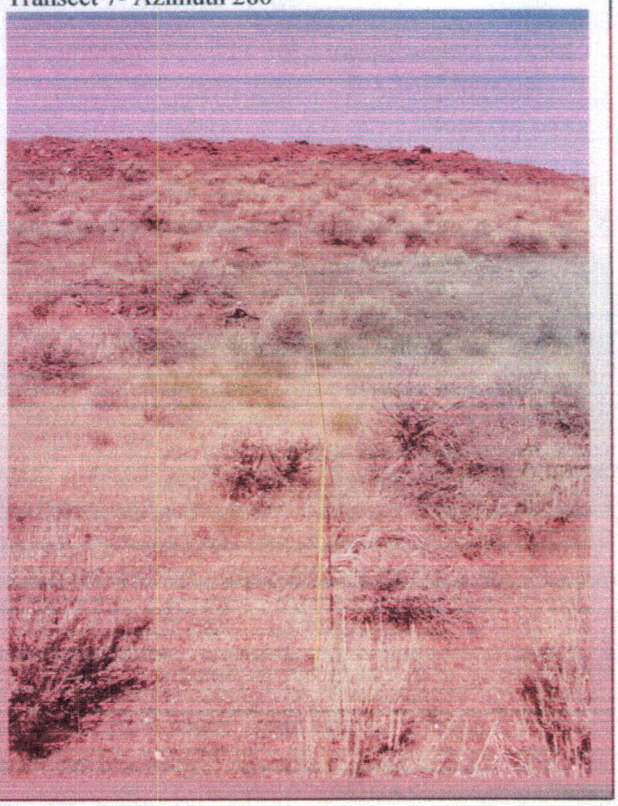
Transect 5- Azimuth350 °



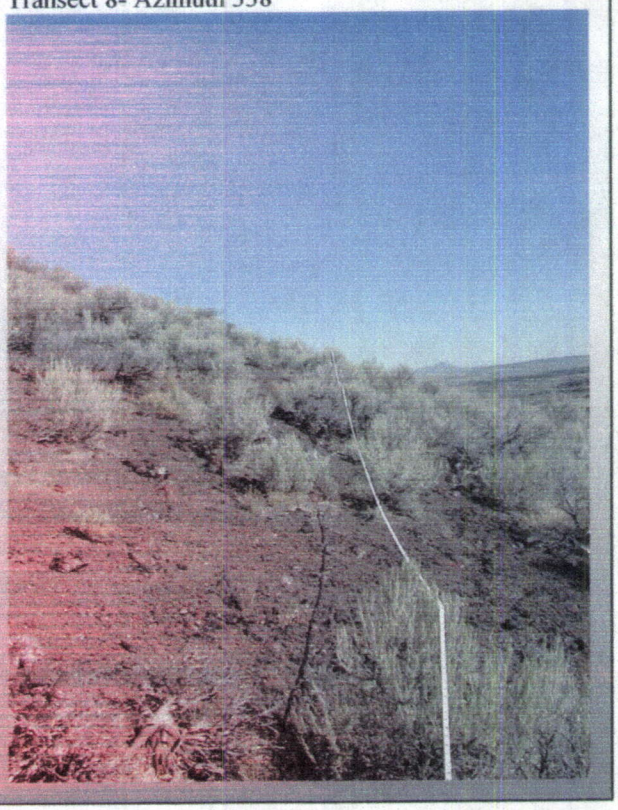
Transect 6- Azimuth 318°



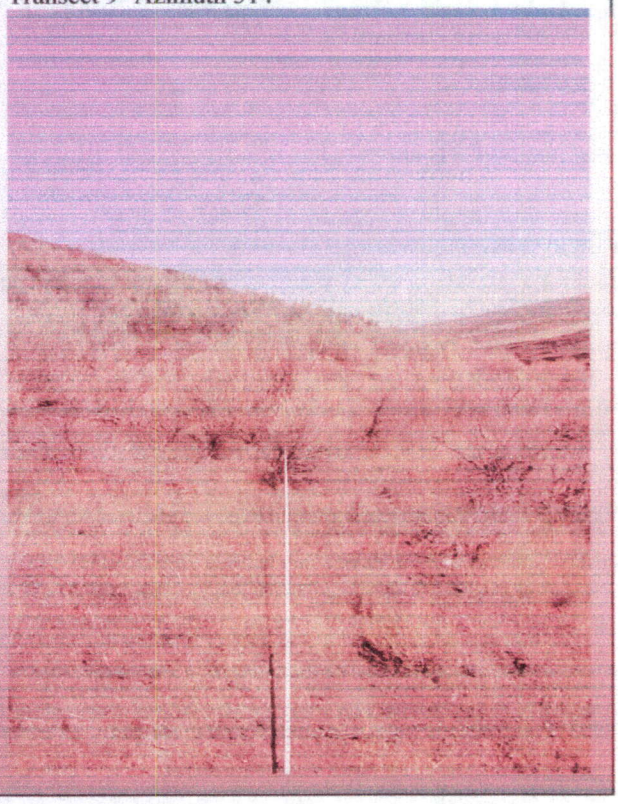
Transect 7- Azimuth 280°



Transect 8- Azimuth 338 °



Transect 9- Azimuth 314°



Transect10- Azimuth 164°

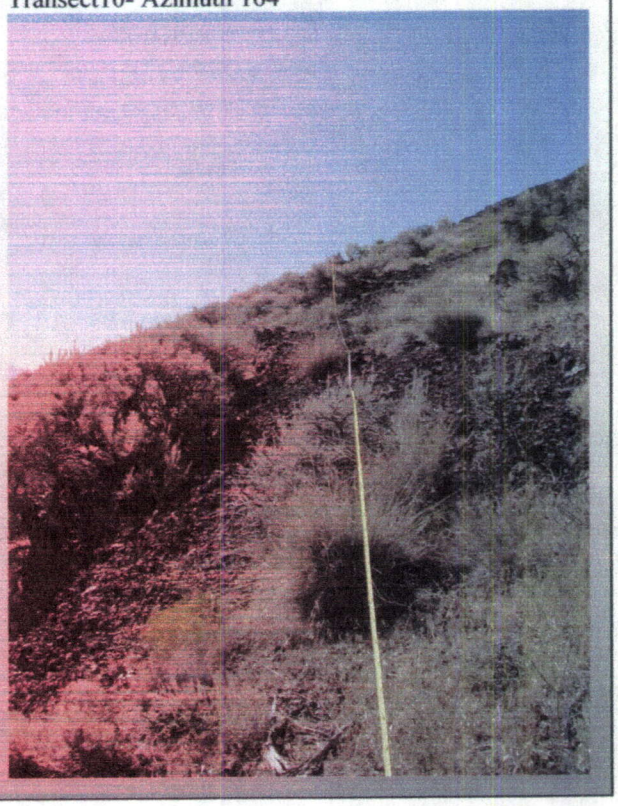


Table 2. An appropriate reclamation seed mix for Red Dome Mine:

Common Name	**Scientific Name**	**Rate (PLS lbs/ acre)**
Grasses		
Sandberg's bluegrass	*Poa secunda*	2
Indian ricegrass	*Oryzopsis hymenoides*	4
Bluebunch wheatgrass	*Pseudoroegneria spicata ssp. spicata*	5
Bottlebrush squirreltail	*Elymus elymoides*	4
Forbs		
Globemallow	*Sphaeralcea coccinea*	0.5
Shrubs		
Rabbitbrush	*Chyrsothamnus nauseosus*	1
Wyoming sagebrush	*Artemisia tridentata var wyomingensis*	1/2
TOTAL		16.5 lbs/ acre

The revegetation requirement for this area is approximately 20.8% total vegetation cover (70% of existing vegetation cover).

Table 3. Vegetation cover at Red Dome Mine

	Scientific Name	Average	St Deviation	St Error	Low	High	Relative Cover	Frequency
Total Vegetation Cover		29.700	8.769	2.773	17.000	44.000		
Total Ground Cover		97.700	3.199	1.012	89.000	100.000		
Bare Soil		2.875	3.357	1.187	1.000	11.000		
Litter		17.800	4.780	1.511	10.000	28.000		
Rock		13.889	13.486	4.495	2.000	43.000		
Gravel		36.900	10.236	3.237	25.000	56.000		
Lichen		3.000			0.000	3.000		
Perennial grasses								
Indian ricegrass	*Oryzopsis hymenoides*	0.600	1.075	0.340	0.000	3.000	0.90	30.00
Sandberg's bluegrass	*Poa sandbergii*	0.100	0.316	0.100	0.000	1.000	0.15	10.00
Sub-total		0.700					1.05	
Annual grasses								
Cheatgrass	*Bromus tectorum*	14.200	9.102	2.878	0.000	27.000	21.39	90.00
Sub-total		14.200					21.39	
Native annual forbs								
Buckwheat	*Eriogonum deflexum*	0.500	0.527	0.167	0.000	1.000	0.75	50.00
Sub-total		0.500					0.75	

	Scientific Name	Average	St Deviation	St Error	Low	High	Relative Cover	Frequency
Introduced annual and biennial forbs								
Halogeton	*Halogeton glomeratus*	0.400	0.966	0.306	0.000	3.000	0.60	20.00
Russian thistle	*Salsola kali*	1.200	1.874	0.593	0.000	5.000	1 81	40.00
Sub-total		1.600					2.41	
Sub-shrubs								
Broom snakeweed	*Gutierrezia sarothrae*	1.300	1.494	0.473	0.000	5.000	1.96	70.00
Sub-total		1.300					1.96	
Shrubs								
Wyoming sagebrush	*Artemisia tridentata var wyomingensis*	10.000	4.714	1.491	0.000	15 000	15 06	90.00
Shadscale	*Atriplex confertifolia*	0.100	0 316	0.100	0.000	1.000	0.15	10.00
Spiny horsebrush	*Tetradymia spinescens*	1.100	1.197	0.379	0.000	3.000	1.66	60.00
Sub-total		11.200					16.87	

Table 4. Scientific and Common Names of Plant Species

Common Name	Scientific Name	Synonyms
Grasses		
Indian ricegrass	*Oryzopsis hymenoides*	*Achnatherum hymenoides*
Bottlebrush squirreltail	*Elymus elymoides*	*Sitanion hystrix*
Nevada bluegrass, Sandberg's bluegrass	*Poa secunda*	*Poa nevadensis, P. sandbergii*
Bluebunch wheatgrass	*Pseudoroegnia spicata ssp spicata*	*Agropyron spicatum*
Needle and thread	*Stipa comata*	*Heterostipa comata*
Forbs		
Gooseberryleaf globemallow	*Sphaeralceagrossulariafolia*	
Scarlet globemallow	*Sphaeralcea coccinea*	
Hood phlox	*Phlox hoodii*	
Penstemon	*Penstemon spp*	
Shrubs		
Douglas rabbitbrush	*Chrysothamnus viscidiflorus*	
Rubber rabbitbrush	*Chrysothamnus nauseosus*	
Winterfat	*Ceratoides lanata*	*Krascheninnikovia lanata*
Mexican cliffrose	*Purshia mexicana*	